

## **Appendix C**

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### **North Bend Gravel Operation Air Quality Technical Report**

# **Air Quality Technical Report**

## **For the North Bend Gravel Operation**

**Produced for URS Corp.  
Seattle, WA.**

**By**

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**November 2001**

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## 1.0 INTRODUCTION

The Cadman Company is proposing to develop a sand and gravel resource of approximately 690 acres in size located on two separate sites just east of North Bend, Washington. Operations at this site will include the mining, conveying, screening, crushing, washing and stockpile of sand and gravel. Onsite processing will include the production of size-sorted aggregate products, asphalt and concrete. The project consists of two sites. The Lower Site is 115 acres (40 acres to be disturbed) surrounded on the west and east by commercial forestry land, on the south by 1-90 and on the north by private property zoned rural-residential. The nearest residential property lies about 1315 feet north of the center of the Lower Site processing area; the closest residence is 1780 feet away. The Upper Site of 578 acres is surrounded on all sides by commercial forestry property with the closest residence nearly a mile away.

This document will analyze potential air quality impacts created by the Proposal, using published emission-rate factors and calculation formulas developed by the U.S. Environmental Protection Agency (EPA). This technical report will analyze the following design options:

- Alternative I - No Action. Under this alternative, no sand and gravel mining or processing would occur on the Lower or Upper Sites. Harvesting of trees on both the Lower and Upper Sites would continue.
- Alternative 2 - Proposal. The Proposal involves developing the Lower and Upper Sites for gravel extraction and processing. Construction of concrete and asphalt batch facilities at the Lower Site is planned in the later stages of site development. Extraction would initially occur at the Lower Site, with material to market site via Exit 34. Material from the Upper Site would be moved to the Lower Site using a covered conveyor with a 36- or 42-inch-wide belt.
- Alternative 2 - Lower Site Option. Over a 5-year period, Cadman, Inc. proposes to extract gravel from about 33.5 acres of the 115-acre site. The remaining land would be left as a buffer. The mining activity and operations area will remain at least one-quarter mile from the nearest established residence.
- Alternative 3 - Lower and Upper Sites (Exit 34 and Exit 38). Under this alternative, gravel extracted from the Lower Site would be transported from the site via Exit 34. After extraction has been completed at the Lower Site, the Upper Site would be developed, with material hauled out via Exit 38 and SE Grouse Ridge Road.
- Alternative 3 - Lower Site Option. Over a 5-year period, Cadman, Inc. proposes to extract gravel from about 33.5 acres of the 115-acre site. The remaining land would be left as a buffer. The mining activity and operations area will remain at least one-quarter mile from the nearest established residence.
- Alternative 4 - Upper Site Only (Exit 38). Under this alternative, the Lower Site would not be developed. Extraction and aggregate processing would occur at the Upper Site, with processed materials hauled out via SE Grouse Ridge Road and Exit 38. Onsite concrete and asphalt batch facilities are not included in this alternative.

## 1.1 METHODOLOGY

Emissions of pollutants from sand and gravel mining come from three types of sources: point sources, area sources, and line sources. The exhaust stacks of stationary equipment such as asphalt or concrete plants are known as point sources. Fugitive dust emissions from the working face, aggregate storage piles and processing areas are termed area sources. The emissions from exhaust stacks of haul trucks and the fugitive dust from truck travel on paved or unpaved roads are called line sources.

Different methodologies are used to determine the impact of each emission source on existing air quality. However, in all cases the process is to first calculate the amount of each pollutant emitted by the source and then determine the resulting concentrations at the project's property lines and other potentially impacted locations.

Formulas and computer models developed by EPA are part of the standard methodology for determining air quality impacts of projects such as the Proposal. The formulas used to calculate emission quantities from point and area sources are from the EPA manual entitled *Compilation of Air Pollutant Emission Factors- (AP-42)*. It is widely accepted that the EPA published emission factors are somewhat conservative and may overestimate particulate matter emissions. While the calculated emissions may, in actuality, be higher than the eventual actual emissions, they are based on the best available information and accepted calculation techniques. Use of conservative emission factors will ensure calculation of "worst case" emissions (a level unlikely to be reached or exceeded).

EPA recommends that onsite data be used to refine the generic data they supply for their fugitive dust equations. Truck travel on dusty roads is a significant source of fugitive dust; consequently Enviroanalysis sampled roads near the project site and the access road to Cadman's Black Diamond operation. This data was used in the appropriate EPA formulas. Similarly, data on the percentage of silt in the aggregate deposit (an important variable in determining fugitive dust levels) was obtained from the records of boreholes conducted on the site in 1998.

Calculation of the amount of particulate matter emitted by all of the mining and processing operations were performed for each of the proposed alternatives. These calculations were based upon the machinery planned to be used and average annual tonnage of material expected to be extracted and processed.

Calculation of the annual particulate matter emissions also took into account a climatic factor adjustment, as suggested in EPA's AP-42, 5<sup>th</sup> edition. The climatic factor adjustment is determined by the number of days each year with precipitation amounts of 0.01 inch or more. The greater the number of days with this level of precipitation, the more that particulate matter emissions, from fugitive dust, are reduced due to soil dampness. The closest source of long-term precipitation data is from Puget Power's Snoqualmie Falls Generating Plant. This site, located at an elevation of 440 feet, has recorded rainfall data for more than 50 years. The long-term rainfall average at the site is approximately 175 days per year with daily precipitation equal to, or in excess of, 0.01 inches. Another source of rainfall data is a privately operated meteorological station located in downtown North Bend at an elevation of 460 feet. This site has been operating since 1994. In general, rainfall increases at higher elevations and the data from the somewhat higher North Bend site do show slightly more days per year with precipitation (an average of 181 days per year from 1994 to 1998). Because the North Bend Gravel Operations Project is proposed to operate over a 25-year period, the

longer term data from Snoqualmie Falls is more appropriate and, since it may be slightly drier than the project site, it better represents a “worse case” analysis of the project. The highest 24-hour particulate matter concentration would be expected to occur during periods of dry weather. Consequently, the calculation of the maximum 24-hour average did not include this rainfall adjustment; however, the calculations of annual impacts do use this factor.

The numbers generated by the EPA formulas are estimates of emission quantities and do not indicate the concentrations of fugitive dust and other pollutants at various locations in the projects vicinity. These calculated emission quantities are best used to provide a general comparison of the alternatives. It is the concentrations of pollutants, which are regulated at the federal and state level to safeguard human health and welfare. A variety of computer dispersion models are used to determine pollutant concentrations. Concentrations of point source emissions are determined by using EPA's SCREEN dispersion model. Concentrations of fugitive dust from area sources require the use of the Fugitive Dust Model (FDM). Emission rates from the exhausts of automobiles and trucks are calculated by EPA's Mobile5b (for CO, NO<sub>x</sub> and SO<sub>2</sub>) and Part5 (for PM<sub>10</sub>) models that are then entered into EPA's CAL3QHC model to determine the concentrations of automobile and truck emissions.

## **1.2 AGENCY COORDINATION AND INVOLVEMENT**

This analysis draws upon a wide range of sources for data including federal, state and local government agencies, the project proponent, equipment manufacturers, published studies of similar projects and local residents. This work was performed with assistance and coordination with the EPA, King County Department of Health, the Bonneville Power Administration, the National Oceanographic and Atmospheric Agency (NOAA), the Washington State Department of Ecology (Ecology) and the Puget Sound Clean Air Agency (PSCAA). PSCAA assistance included providing copies of recent, relevant EIS's, permitting data on a similar asphalt plant, copies of applicable regulations, and guidance on operating the computer dispersion models. Staff at the Bonneville Power Administration and NOAA assisted in researching the availability of long-term meteorological data for the North Bend area (and confirmed that it is not available). Information on shorter-term meteorology was provided by T. Dunklee and Eric Molstad of The Weather Center in North Bend.

## **2.0 AFFECTED ENVIRONMENT**

Characterizing the existing environmental conditions in the vicinity of this project is important to an air quality analysis. Included in evaluations of the existing environmental conditions are the specifics regarding the geology of the site, the local meteorology and, when available, information on the current air quality levels. The focus is on the conditions that cause fugitive dust, because fugitive dust is the predominant pollutant of concern from aggregate mining operations.

The primary meteorological and geological conditions of the local area which play an important role in determining the amounts of fugitive dust are:

- The strength of winds affecting the project site
- The proportion of fine particles (silt) in the sand and gravel deposit
- The average moisture content of the deposit
- The number of days each year with measurable precipitation
- The concentration of dispersed dust (and the other pollutants emitted by sand and gravel mines) impacting adjacent properties depends upon the following factors:
  - The prevailing direction of winds particularly during the dry season (June through September)
  - The location of dust creating activities (both in a horizontal and a vertical plane) relative to other land uses

The emission rates of the other pollutants emitted from combustion sources in sand and gravel mines, such as carbon monoxide, sulfur dioxide, nitrogen dioxide and particulate matter in the form of PM<sub>10</sub> are not determined by meteorological conditions.

The significance of those impacts depends on the land uses of the affected properties, with residential properties being a much more sensitive use compared to commercial forestland or interstate right-of-way.

### **2.1 REGIONAL CLIMATE AND METEOROLOGY**

The North Bend area has a modified version of Pacific Maritime climate that controls weather in Seattle and most of the Puget Sound Basin. The Pacific maritime climate is characterized by moderate temperatures, wet winters, and frequent onshore flows of moist marine air. Monthly average temperatures (in Fahrenheit) range from the 30s and 40s in winter and range from the 50s to the mid-70s in summer. Annual precipitation varies greatly depending on location and elevation, varying from nearly 102 inches at Cedar Lake, 82 inches at the Western Riverbend neighborhood and 62 inches in central North Bend. The closest long-term monitoring site is at Snoqualmie Falls, where rainfall ranges from 47 to 81 inches, with a long-term average of over 61 inches. This is almost identical to shorter-term data from central North Bend. There are 175 days a year with rainfall of 0.01 inch or greater at Snoqualmie Falls. Climate data used in the air quality analysis is from Snoqualmie Falls and covered the period 1931 to 1998.

Figure 1 illustrates the number of days per month with measurable precipitation, based on long-term data from Puget Power's generating station at Snoqualmie Falls.

In the Pacific Maritime regime, winds generally range south to southwest in the winter or during other rainy periods with southwest winds predominating. Winds during fair periods, and generally throughout the warm months, are west to northwest. However, climate in the North Bend area is modified by the influence of frequent westward air flows of dry air over the Cascades. These winds occur frequently during periods of high pressure and can reach speeds of up to 80 mph. Winds above 20 mph are from the east-southeast far more than any other direction. (personal conversation Eric Molstad 3-7-01). Figure 2 shows that the months with the greatest frequency of high winds are also the months with the most rainfall. Figures 3 and 4 illustrate the pattern of wind distribution for January and July for North Bend (source: Bonneville Power Administration) and are consistent with local wind monitoring data.

On a more localized scale, one would expect the airflows in the vicinity of the project site to be influenced by the mountainous topography of the valleys of the middle and south forks of the Snoqualmie River and Snoqualmie Pass. The local area has strong down slope drainage winds which tend to reduce the frequency of inversions in the Exit 34 area compared to much of the Puget Sound lowlands (Personal conversation, Eric Molstad 3-7-01).

At the mine site itself, the fact that the extraction and processing activities occur within a "bowl" with a rim means that dust emissions tend to be trapped rather than dispersing widely. Figure 4 illustrates the relative occurrence of winds during the month of July as measured at North Bend. Historically July is the driest month of the year and it also combines wind speeds and wind directions such that it is the month with the greatest potential for fugitive dust emissions affecting the residential areas closest to the mine site.

Temperature inversions are common throughout the Puget Sound area in fall and winter, and would have an exaggerated effect on air quality in an area such as the Snoqualmie River Valley. In most cases these pollutant-trapping inversions have an upper lid at an altitude between 500 and 2,500 feet and occur during the night and break up by early afternoon. The project lies within the areas subject to inversions.

## **2.2 LOCAL AMBIENT AIR QUALITY: DESCRIPTION OF POLLUTANTS AND REGULATIONS**

The focuses upon those pollutants which are of concern in the Puget Sound region and which are likely to be emitted by the Proposal. The pollutants with the greatest impact upon air quality in the Puget Sound region are particulate matter, carbon monoxide and ozone (formed from chemical reactions with hydrocarbons, oxides of nitrogen and sunlight). The primary impacts to air quality generated by this type of project are due to dispersion of dust particles by the prevailing winds and/or the turbulence caused by moving machinery and trucks. These dust emissions are typically termed "fugitive dust". The PSCAA has stated that coarse particulate matter is the primary issue of concern for sand and gravel mine projects. Other pollutants include carbon monoxide, oxides of nitrogen and sulfur dioxide emissions from the diesel engines of earth-moving machinery and trucks and the complex hydrocarbon emissions from asphalt production and diesel engines.





Air quality is regulated in the Puget Sound region by federal, state and local agencies. The EPA established National Ambient Air Quality Standards (NAAQS) for a limited number of pollutants with the enactment of the Clean Air Act of 1970 (Figure 5). These are termed “criteria” pollutants. Air quality is regulated in the Puget Sound region by federal, state and local agencies. Ecology and the PSCAA operate monitoring stations to measure concentrations of the criteria pollutants. Regions in the State that exceed the NAAQS are declared to be in “nonattainment” and are required to develop programs such as Automobile Emission Checks meet the standards. Once an area has demonstrated attainment these pollution control programs must be maintained in place for at least 10 years and the area is termed to be a “maintenance area”. This is currently the status of the central Puget Region for carbon monoxide, ozone and particulate matter.

The following is a more detailed discussion of the pollutants likely to be emitted by this project.

### **2.2.1 Particulate Matter**

Particulate matter consists of particles of wood-smoke, diesel smoke, dust pollen or other materials. It has traditionally been measured in two forms: total suspended particulate (TSP) and  $PM_{10}$ . TSP is airborne particulate matter of all sizes;  $PM_{10}$  (respirable or fine particulate matter) is a subset of TSP and is defined as being smaller than 10 micrometers in diameter. Due to concerns about the effect of very fine particulate matter such as that found in wood smoke and combustion engine exhaust, the EPA in 1997 established separate regulations for ultra-fine particulate matter smaller than 2.5 microns in diameter ( $PM_{2.5}$ ). Monitoring data from three  $PM_{2.5}$  sites that have had a history of high particulate levels (Seattle, Kent, and Tacoma) shows 98th percentile levels of 35-72  $\mu\text{g}/\text{m}^3$  compared to the 65  $\mu\text{g}/\text{m}^3$  24-hour standard.  $PM_{2.5}$  levels in North Bend would be lower than these heavily industrialized areas.

Coarse particles much greater than 10 micrometers in diameter makeup most of the fugitive emissions from sand and gravel mines and represent a nuisance rather than a health threat (personal conversation, G. Pade, PSCAA, 1999). Coarse particles settle out of the air fairly close to where they are produced.  $PM_{10}$  remains suspended in the air for long periods of time and is readily inhalable deep into the smaller airways of human lungs. High ambient concentrations contribute to impaired respiratory functioning. Fine particulate matter is primarily responsible for haze that impairs the visibility of distant objects.

Studies by Ecology have shown that the burning of wood in stoves and fireplaces can account for more than 80% of the  $PM_{10}$  concentrations in areas and periods of heavy woodstove use. The diesel engines of trucks and heavy equipment are another source of particulate matter.



The project site is located outside of any PM<sub>10</sub> maintenance areas, which are concentrated in the urban industrial areas of Everett, Seattle, and Tacoma. The closest comparable particulate monitoring station site is operated by the PSCAA and is located in the Forest Park neighborhood of North This station is in a region that is much more densely settled than the North Bend area. In 1998 Lake Forest Park had no exceedances of the NAAQS, recording an annual arithmetic mean of 22 µg/m<sup>3</sup> and a 24-hour maximum of 65 µg/m<sup>3</sup>. Since its establishment in 1991 this monitor has recorded 24-hour maximums ranging from 135 to 65 µg/m<sup>3</sup> and annual averages ranging from 16-28 µg/m<sup>3</sup>. Due to its less dense residential development and windy local climate, somewhat lower particulate concentrations can be expected in the North Bend area. However, our analysis of the cumulative impacts of the Proposal conservatively assume similar existing background conditions in the North Bend area due to the extensive use of wood for fuel in this area.

The Puget Sound region has met the Federal standards for particulate matter since 1990 and in 1998 was re-designated as in attainment for the PM<sub>10</sub> standards. New standards for very fine particulate, known as PM<sub>2.5</sub>, went into effect in 1997 and the monitoring data indicates that the region is in attainment of the new standards. In July 1998, the PM<sub>2.5</sub> standard was remanded by a Federal Court.

In addition to the federal standards for fine particulate matter there is a state regulation for nuisance fugitive dust. The "Fallout dust" standard is rarely used but may be applicable to the nuisance dust issues created by gravel mining operations.

Because a major source of particulate matter in residential areas is the use of woodstoves and fireplaces, PSCAA has developed a control program, limiting residential wood burning ("Burn Bans"), based upon monitored levels of PM<sub>10</sub>. The use of stoves not meeting emission standards or non-certified pellet wood stoves is curtailed when a 24-hour average of 60 µg/m<sup>3</sup> is measured and Ecology declares the first stage of an "impaired air quality" condition. When monitored 24-hour average concentrations of PM<sub>10</sub> exceed 105 µg/m<sup>3</sup> the use of all wood burning stoves and fireplaces is prohibited. In addition to "impaired air quality" declarations, Ecology can declare a "Forecast Stage" of an "Air Quality Episode" when stagnant atmospheric conditions are expected to last for 24 hours. There were no burn bans in 1998, two in 1997, one in 1996, and one in 1995. Outdoor burning, normally allowed in areas outside the urban growth management areas (such as the site), is prohibited during a burn ban. Burn bans are credited with reducing particulate matter concentrations by 25 to 35%. Local meteorology during the heating season will determine the frequency and duration of these restrictions. There were 62 hours of burn bans in 1999 and 225 hours in 2000.

### **2.2.2 Carbon Monoxide**

Carbon monoxide is a toxic, clear and odorless gas. Carbon monoxide interferes with the blood's ability to absorb oxygen and impairs the heart's ability to pump blood. Carbon monoxide is the primary criteria pollutant associated with motor vehicle traffic. Monitoring for carbon monoxide is performed throughout the Puget Sound region by Ecology and the PSCAA. There are no monitoring sites either close to or representative of conditions near the proposed mine. Existing locality-wide background concentrations of carbon monoxide are primarily traffic generated, with a seasonal contribution from wood burning stoves, fireplaces and land clearing fires. There are no monitoring sites within 15 miles of North Bend. Local CO levels are estimated to range from 1.0 to 3.0 parts per million (ppm). Based upon EPA guidance, the

background 1-hour PM peak concentration can be assumed to be 2.1 ppm and the 8-hour average background is assumed to be 1.5 ppm.

Reduction of carbon monoxide concentrations is focused primarily on reducing motor vehicle emissions. Ecology requires that gasoline fueled vehicles registered in much of central Puget Sound pass an emission test every 2 years. Vehicles that fail this test must be repaired and re-tested. The motor vehicle emission check program has proven effective in reducing emission rates.

Most of the urbanized (western) portions of Snohomish, King and Pierce Counties have been in non-attainment for carbon monoxide since 1991. In 1997 they were re-designated as being in attainment but subject to "Maintenance Area" requirements. The project site lies outside the carbon monoxide non-attainment and the City of North Bend's Urban Growth Boundary, which means that open burning of land clearing debris is permitted.

### **2.2.3 Ozone**

Ozone is a pungent-smelling, colorless gas. It is a pulmonary irritant that affects lung tissues and respiratory functions and, at concentrations between 0.15 and 0.25 ppm, causes lung tightness, coughing and wheezing.

Ozone is produced in the atmosphere when nitrogen oxides and some hydrocarbons (known as volatile organic compounds or VOC's) chemically react under the effect of strong sunlight. Unlike carbon monoxide, however, ozone and the other reaction products do not reach their peak levels closest to the source of emissions, but rather at downwind locations affected by the urban plume after the primary pollutants have had time to mix and react under sunlight. Peak ozone concentrations in the Puget Sound region have been measured in an arc 15 to 30 miles in radius to the east and south of Seattle/Bellevue. The closest currently operating sampling site is located in Enumclaw, approximately 25 miles south of the project. Based on observations at this and other locations, EPA re-designated most of Snohomish County and all of King and Pierce Counties in 1991 as being in non-attainment for ozone. The Enumclaw sampling site recorded one exceedance in 1987, three in 1990, two in 1994 and none in the other years from 1984 to 1998. Ozone levels in the project area are estimated to be .08 to 0.11 ppm as an annual maximum 1-hour average, compared with the 0.12 ppm 1-hour standard. In 1997, EPA enacted an 8-hour standard of 0.08 ppm that replaced the 1-hour standard. The Puget Sound region has remained in compliance with the 1-hour standard for several years but the 8-hour standard is more stringent and the region would require only one exceedance during the summer of 1999 to be out of compliance for the 8-hour standard.

From 1991 to 1997 most of Snohomish County and all of King and Pierce Counties were designated as non-attainment for ozone because ozone levels exceeded the NAAQS. In 1997 they were re-designated as being in attainment but subject to "Maintenance Area" requirements. Also in 1997, a more protective 8-hour standard replaced the previous 1-hour standard but was remanded in Federal Court July 1998.

### **2.2.4 Sulfur Dioxide**

Sulfur dioxide is a colorless, corrosive gas with a bitter taste. It has been associated with respiratory diseases. Sources of sulfur dioxide include electric power generation plants, paper mills, smelters and diesel engines. It reacts with atmospheric moisture to form sulfuric acid. Sulfur dioxide is monitored at several locations in the heavily industrial areas of Everett, Seattle, and Tacoma. The Puget Sound region is in

compliance with federal and state standards with no exceedances in the 1988 to 1998 period. Concentrations at the project site are expected to be well below these standards.

### **2.2.5 Nitrogen Dioxide**

Nitrogen dioxide is a brownish, poisonous gas that reacts with water vapor to form nitric acid. It has been associated with respiratory diseases and is one of the essential precursors in the formation of ozone. Nitrogen dioxide is formed from the high temperature combustion of fuels (such as diesel engines) and subsequent atmospheric reactions. It reacts with atmospheric moisture to form nitric acid, which, together with sulfuric acid, falls as “acid rain” damaging vegetation and freshwater marine ecosystems.

Nitrogen dioxide has been monitored at sites in Seattle and Enumclaw only since 1996. Monitored levels at both sites have far lower than the standards. Levels at the project site can be estimated as being similar to those at Enumclaw (for example, approximately 0.008 ppm as an annual average compared to the standard of 0.05 ppm).

### 3.0 ENVIRONMENTAL IMPACTS

#### 3.1 INTRODUCTION

The primary pollutants emitted by sand and gravel mines are:

- Fugitive dust (particulate matter) from the trucking, earth-moving, crushing and screening operations and combustion source particulate matter from the asphalt facility, the engines of trucks and equipment and slash burning
- Carbon monoxide, sulfur oxides and oxides of nitrogen from the diesel powered front-end loaders, bulldozers, highway trucks, the asphalt facility and the burning of land clearing debris
- Hydrocarbons of many types from the diesel engine exhaust, evaporation of fuels, the asphalt plant operations and slash burning

Fugitive dust is the major pollutant from sand and gravel mining in terms of quantities produced, with truck movement being one of the largest sources. The general public often associates dust with these operations since fugitive dust can be quite visible on the access roads serving mines. Fugitive dust emissions occur from sand and gravel mines because the mining activities remove the gravel deposits' vegetative cover ("overburden") allowing the sun and wind to dry the smaller particles in the deposit (silt and clay). The movement of machinery and vehicles adds to the existing wind turbulence along roadways and at working faces causing dust to rise in to the air and be transported by the prevailing winds. The processing of the aggregate by crushing, screening, secondary crushing and dropping into stockpiles also results in particulate emissions. Haul trucks pulverize and disperse fugitive dust as they move along the paved access road and out onto the public road system.

##### 3.1.1 Description of the Proposal and Alternatives

Four different alternatives are envisioned for the North Bend Gravel Operations Project. They are briefly described next. Several of the alternatives are divided into distinct operational phases with differing products, production levels and machinery used. Table 1 describes each phase of operation and Table 2 provides a summary of the equipment and its location for each phase under all alternatives (except Alternative 1).

**TABLE 1  
PHASES OF THE MINING OPERATION**

Phase	Activity
Phase 1	Overburden cleared from 40 acres of the Lower Site to construct berms
Phase 2	Excavate floor of pit to design level and expand its area to hold equipment
Phase 3	Construction of processing plant, conveyor on Grouse Ridge
Phase 4	Start removal of overburden from Upper Site
Phase 5	Start excavation and primary processing on Upper Site Processing of aggregates from Upper Sites begins on Lower Site
Phase 6	Processing continues
Phase 7	Construction of asphalt and concrete plant
Phase 8	Processing continues
Phase 9	Processing continues
Phase 10	All equipment and buildings are removed, re-grading and reclamation is completed

**TABLE 2  
EQUIPMENT LOCATIONS**

	Phase	D6 Dozer	D9 Dozer	992 Loader	988 Loader	980 Loader	Primary Crusher	Scalping Screens	Belly Scrapper	Service Truck	Process Plant	Concrete Plant	Asphalt Plant	Conveyor Belt	Cat 769 Haul Trucks	Highway Gravel Haul Trucks	Asphalt & Concrete Haul Trucks
Lower Site																	
Alt. 2 (Proposal)	1		X	X					X	X							
	2		X	X	X		X	X	X	X						X	
	3		X	X	X		X	X	X	X						X	
	4				X		X	X	X	X				X		X	
	5				X	X				X	X			X		X	
	6				X	X				X	X			X		X	
	7				X	X				X	X	X	X	X		X	X
	8				X	X				X	X	X	X	X		X	X
	9	X					X			X	X	X	X	X		X	X
	10	No equipment															
Alt. 3 (Lower and Upper Sites)	1		X	X					X								
	2		X	X	X		X	X	X							X	
	3		X	X	X		X	X	X	X						X	
	4				X		X	X	X	X						X	
	5				X	X				X							
	6					X				X		X	X			X	
	7					X				X		X	X			X	X
	8					X				X		X	X			X	X
	9	X					X			X		X	X			X	X
	10	No equipment															
Alt. 4 (Upper Site Only)	All Phases	No equipment															
		No equipment															
Upper Site																	
Alt. 2 (Proposal)	1																
	2																
	3																
	4		X	X						X							
	5		X	X			X	X		X				X	X		
	6		X	X			X	X		X				X	X		
	7		X	X			X	X		X				X	X		
	8		X	X			X	X		X				X	X		
	9		X	X			X	X		X				X	X		
	10	No Equip.															
Alt. 3 (Lower and Upper Sites)	1																
	2																
	3																
	4		X	X													
	5		X	X		X	X	X	X							X	
	6	X	X	X		X	X	X	X	X						X	
	7	X	X	X		X	X	X	X	X						X	
	8	X	X	X		X	X	X	X	X						X	
	9	X	X	X		X	X	X	X	X						X	
	10	No equipment															
Alt. 4 (Upper Site Only)	All Phases	X	X	X	X		X	X	X	X					X	X	

The aggregate would be extracted from the working face and transported to the primary crusher by front-end loaders. Approximately 5% of the deposit is oversize (> than 1.5") and requires crushing. However, the entire annual production of 2.1 million tons would pass through the primary crusher and then be stockpiled. During Phase I most of the production would be sold directly from this primary stockpile as pit-run material. During subsequent phases most of the production would be processed, passing through a series of crushing and sorting steps resulting in stockpiles of size-sorted gravel and sand. Approximately 170,000 tons of processed aggregate would be used for asphalt and 142,500 tons for concrete production.

Diesel trucks, of a variety of sizes, would transport the pit-run, processed aggregate, asphalt and concrete to end-users. An unpaved onsite road exists, providing access to a sporadically used gravel pit on the Lower Site. This road would be paved to provide access for trucks taking on loads of aggregate and for the mine's employees. Truck traffic is calculated at approximately 360 loads per day of aggregate, 156 loads of concrete and 60 loads of asphalt (98 peak hour trips for Alternative 2). Alternative 3 would have slightly more truck use (110 peak hour trips).

For all the alternatives, except Alternative 1, the Lower Site would operate from 5 a.m. to 10 p.m., Monday through Saturday, 306 days per year. The Upper Site would operate from 7 a.m. to 5 p.m., five days a week. Truck hauling from the Lower Site would occur 24 hours a day Monday through Saturday.

#### **3.1.1.1 Alternative 1 – No Action**

No gravel mining would occur. The existing forestry operations would continue with harvest cuts not likely to be scheduled before the year 2050 (due to the young age of the existing plantations).

#### **3.1.1.2 Alternative 2 – Proposal**

Alternative 2 for the North Bend Gravel Operations Project would extract about 2,100,000 tons of sand and gravel from the pit annually. Production would start on the Lower Site then proceed to the Upper Site when the Lower Site's aggregate resource is exhausted. The mine's operations will develop in ten phases. Primary processing of sand and gravel would occur initially on the Lower Site then move to the Upper Site. Secondary crushing, screening and washing would occur at the Lower Site. Asphalt and concrete would also be produced on the Lower Site. Products would be hauled by truck to I-90 using Exit 34 (Edgewick Road).

### **ALTERNATIVE 2 – LOWER SITE OPTION**

This option reduces the size of the Lower Site processing area and relocates the outboard end of the Grouse Ridge conveyor belt, surge pile and the aggregate storage areas toward the southwest.

#### **3.1.1.3 Alternative 3 – Lower and Upper Sites (Exit 34 and Exit 38)**

Under this scenario, aggregate processing and concrete and asphalt batching would start on the Lower Site and continue until the Lower Site's resource is exhausted. Then, aggregate would be mined from the Upper Site. Aggregate destined for asphalt and concrete production would be transported to the Lower Site; all other aggregate would be crushed, screened and washed at the Upper Site.

### **ALTERNATIVE 3 – LOWER SITE OPTION**

This option reduces the size of the Lower Site processing area and relocates the outboard end of the Grouse Ridge conveyor belt, surge pile and the aggregate storage areas toward the southwest.

#### **3.1.1.4 Alternative 4 – Upper Site Only (Exit 38)**

Aggregate would be extracted from the Upper Site only with no activity on the Lower Site. Exit 38 would be the route used by the haul trucks.

### **3.2 CONSTRUCTION IMPACTS**

The construction phase of the North Bend Gravel Operations Project would consist of:

- Excavating the passive water storage pond approximately 98,000 cubic yards.
- Removing the overburden from the Lower Site.
- Building berms on the north and south sides of the processing area. The berms will require approximately 113,000 cubic yards of material.
- Disposing of unusable woody material (“slash”)
- Clearing a route for the aggregate conveyor transversing the western slope of Grouse Ridge.
- Paving the Lower Site access roads and processing area.
- Building the aggregate processing plant and the concrete and asphalt facilities.
- Reclaiming the mine site by re-contouring, spreading topsoil and replanting with grasses and trees

Construction impacts would be fugitive dust (generally coarser than PM<sub>10</sub>) generated by earth moving and the exhaust emissions of fine particulate matter, carbon monoxide and oxides of nitrogen, and sulfur from bulldozers and front-end loaders. Alternatives 2 and 3 would have construction emissions of very similar magnitude, calculates at 302 lbs/day (24 tons/year) of PM<sub>10</sub>, 146 lbs/day (12 tons/year) of PM<sub>2.5</sub>, 7,2 lbs/day (1.1 tons/year) of CO, 10.1 lbs/day (1.5 tons/year) of NO<sub>2</sub> and 1.8 lbs/day (0.2 tons/year) of VOCs.

### **DISPOSAL OF WOODY DEBRIS**

For Alternatives 2 and 3, both the Lower and Upper Sites would require some clearing before any earth moving activities take place. For Alternative 4 only the Upper Site would be cleared. It is planned that 40 acres would be prepared for mining at the Lower Site over a 3-year period and 260 acres at the Upper Site over a 25-year period. Although both sites were logged in the 1988 to 1997 period (personal conversation Dan Moore, Weyerhaeuser Inc.) they are now reforested. In addition, there is woody material on the forest floor, estimated at from 25 to 45 tons per acre. Disposal of non-utilizable woody debris could include chipping for mulch or soil conditioner or hauling offsite for chipping/burning, or stockpiling on site for spreading back after mining in a sector is finished. There are air quality and biological benefits to choosing not to burn this material.

Woody debris tonnage was estimated by walking the Lower and Upper Sites and comparing the debris to USFS photographs of forest sites with known quantities of wood waste. Nearly all the woody debris is located on the Upper Site. Emission factors developed by EPA and by the U.S. Forest Service were used to calculate the quantity of pollutants from burning woody waste.

For Alternatives 2 and 3, it is estimated the following emissions would occur if all the material (including stumps) were to be burned:

- PM<sub>10</sub> 8.6 tons/year
- PM<sub>25</sub> 1.7 tons/year
- Carbon monoxide 59 tons/year
- VOCs (ozone precursors) 1.2 tons/year

These quantities of pollutants should not result in concentrations exceeding the NAAQS at areas outside the lease boundaries if burning is properly conducted during conditions of good atmospheric dispersion. Changes in weather while burning in progress may lead to higher pollutant concentrations. Odors from the fires may be detectable under certain wind conditions.

The construction impacts for the alternatives are as follows.

### **3.2.1 Alternative 1 – No Action**

Alternative 1 would have no construction impacts.

### **3.2.2 Alternatives 2 and 3**

Alternatives 2 and 3 would have construction impacts of very similar magnitude. Alternative 3 will not involve the construction of the conveyor belts down the west slope of Grouse Ridge, but the air quality impacts of that portion of the project are minimal.

#### **DISPOSAL OF WOODY DEBRIS**

Emissions from burning the woody debris under Alternative 2 and 3 are summarized above.

#### **CONSTRUCTION OF ASPHALT AND CONCRETE BATCH FACILITIES**

Construction impacts for the asphalt and concrete batch facilities would be minimal, as the Lower Site would already be cleared and graded with no additional earth moving required. Slight increases in vehicle emissions can be expected from the additional trucks and cars of the batch facility construction contractor.

##### **3.2.2.1 Alternatives 2 and 3 – Lower Site Options**

The Lower Site Options to Alternatives 2 and 3 would have the same construction impacts as Alternatives 2 and 3.

### **3.2.3. Alternative 4 – Upper Site Only (Exit 38)**

Alternative 4 would have fewer impacts on inhabited areas than Alternatives 2 or 3 because only the Upper Site would be used. Exposed areas of the project on the Upper Site may be subject to higher winds than on the Lower Site and thus may be transported further, but the distance from the Upper Site to residences is also much greater. Overall, construction on the Upper Site would have fewer impacts than on the Lower Site.

#### **DISPOSAL OF WOODY DEBRIS**

Emissions from burning the woody debris under Alternative 4 would be only slightly less than for Alternatives 2 and 3 on a per year basis, but the mass of material to be disposed of is much greater on the Upper Site and burning would continue for more years.

#### **CONSTRUCTION OF ASPHALT AND CONCRETE BATCH FACILITIES**

Alternative 4 has no batch facilities and would not have these impacts.

### **3.3 OPERATION IMPACTS**

#### **3.3.1 Emission Quantities**

##### **3.3.1.1 Alternative 1 – No Action**

There are no project impacts under Alternative 1. Existing uses of the site for commercial forestry and gravel extraction for logging road construction and repair would continue.

##### **3.3.1.2 Alternative 2 – Proposal**

The quantities of emissions for particulate matter, carbon monoxide, the oxides of nitrogen and sulfur and VOCs (volatile organic compounds) were calculated for all the operations expected to occur under the Proposal (Phase 8 represents full operating levels). The calculations used the expected facility operating characteristics, heavy equipment emissions (personal conversations Scott McDougal, Caterpillar, Inc) and production rates (personal conversations Bill Fare, Rod Shearer of Cadman, Inc) to determine the emissions for the short-term (pounds per 24-hour day) and the long-term (tons per year). The daily emissions are the quantities expected over a day's operation during a peak production month (assuming daily aggregate production of 13,125 tons--following the terminology and data in section 3-12 Transportation). The annual emissions are the quantities expected with a production of 2.1 million tons. This information is presented quantitatively in Table 3.

**TABLE 3 EMISSION INVENTORY FOR ALTERNATIVE 2 AT PHASE 8**  
**EMISSIONS IN POUNDS PER DAY AND TONS PER YEAR**

<b>Operation</b>	<b>PM<sub>10</sub></b>	<b>PM<sub>2.5</sub></b>	<b>CO</b>	<b>SO<sub>2</sub></b>	<b>NO<sub>x</sub></b>	<b>VOCs</b>
Dust from removing overburden						
Lower Site (1)	301 (24.0)	146 (11.6)	0	0	0	0
Upper Site	415 (33.0)	152 (12.1)	0	0	0	0
Dust from excavation at working face						
Lower Site (1)	0.7 (0.1)	0.3 (0.0)	0	0	0	0
Upper Site	1.4 (0.1)	0.5 (0.0)	0	0	0	0
Dust from primary crusher						
Lower Site (1)	12.8 (1.0)	4.7 (0.4)	0	0	0	0
Upper Site	25.6 (2.0)	9.4 (0.7)	0	0	0	0
Dust from pit conveyor and screening						
Lower Site	7 (0.5)	2.6 (0.2)	0	0	0	0
Upper Site	12 (1.2)	4.4 (0.4)	0	0	0	0
Dust from truck loading						
Lower Site	0.4 (0.0)	0.1 (0.0)	0	0	0	0
Dust from movement of equipment in processing area						
Lower Site	107.4 (8.6)	39.4 (3.2)	0	0	0	0
Upper Site	142.1 (11.3)	52.2 (4.1)	0	0	0	0
Wind erosion from processing area & storage piles						
Lower Site	9 (0.7)	8.8 (0.8)	0	0	0	0
Upper Site	49 (3.9)	7.7 (0.6)	0	0	0	0
Highway truck movement onsite (assumes road washing 50% efficiency)						
Lower Site	236 (18.8)	86.7 (6.9)	0	0	0	0
Dust from concrete plant operations						
Lower Site	65 (5.2)	23.9 (1.9)	0	0	0	0
Dust from asphalt plant operations						
Lower Site	24 (1.9)	8.8 (0.7)	0	0	0	0
Asphalt plant stack	16 (2.5)	5.9 (0.9)	278 (42.5)	4.1 (0.6)	20 (3.1)	14 (2.1)
Highway trucks exhaust stacks	3.2 (0.5)	1.2 (0.2) (2)	58 (8.9)	ND	51 (7.8)	10 (1.5)
Front-end loader exhaust						
Lower Site	1.3 (0.2)	0.5 (0.1)	8.5 (1.3)	25.3 (3.9)	278 (42.8)	3 (0.5)
Upper Site	1.3 (0.2)	0.5 (0.1)	8.5 (1.3)	25.3 (3.9)	278 (42.8)	3 (0.5)
Burning of clearing woody material						
Lower Site	(1.7)	(0.6)	(11.4)	0	0	(0.2)
Upper Site	(6.9)	(1.1)	(47.4)	0	0	(1.0)
Bulldozer exhaust						
Lower Site	0.7 (0.1)	8.8 (0.8)	7.2 (1.1)	ND	10.1 (1.5)	1.8 (0.3)
Upper Site	0.7 (0.1)	0.3 (0.0)	7.2 (1.1)	ND	10.1 (1.5)	1.8 (0.3)
Total Emissions Phase 8						
Lower Site	484 (41.8)	178 (15.1)	352 (65.2)	29.4 (4.5)	359 (55.2)	29 (5.4)
Upper Site	647 (58.7)	237 (20.3)	15.7 (51.2)	25.3 (3.9)	288 (44.3)	1.8 (0.3)

(1) This activity (and its emissions) is a Construction task at the Lower Site. These operations and their emissions cease at the Lower Site before beginning at the Upper Site.

(2) PM<sub>2.5</sub> emissions from trucks are from EPA published data.

(3) The removal of the overburden on the Lower site is considered a construction activity.

ND = emission data not available

Note: Annual emissions take into account the effect of wet days to reduce wind-blown emissions. The daily emissions assume that no rainfall of 0.01 inch or more has fallen that day.

The following is a comparison of PM<sub>10</sub> Emissions for all alternatives at Phase 8:

- Alternative 1 – No Action 0 tons/year
- Alternative 2 – Proposal 101 tons/year
- Alternative 3 – Lower and Upper Sites 111 tons/year
- Alternative 4 – Upper Site Only 90 tons/year

### **3.3.2 Concentrations of Fugitive Dust Emissions**

The Fugitive Dust Model was run for each alternative with the following assumptions:

- The equipment and its location are modeled as indicated in Table 2 for Phase 8 of each alternative.
- Receptors were spaced every 50 meters around the perimeter of the Lower Site and at the closest residences both north and south of I-90 and in the middle fork of the Snoqualmie River valley.
- Eight hypothetical days of meteorology were created – each day represents an extreme “worst case” with winds of one speed from one direction for 24 hours, (i.e. 24 hours of steady winds from the north, east, south and west at both low and high wind speeds).
- A low wind speed 4.4 mph (2 meters/second) and a high wind speed 45 mph (20 meters/second) were used. Some EPA screening models use a 1.0 meter/sec wind speed, but fugitive dust does not begin to “lift off the ground” in any significant amounts with such low winds.

The results of the FDM modeling are summarized in Table 4 (no FDM modeling was performed for Alternative 1).

**TABLE 4**  
**MAXIMUM PM<sub>10</sub> CONCENTRATIONS IN MICROGRAMS/CUBIC METER**

<b>Scenario</b>	<b>24-Hour</b>	<b>Annual</b>
<b>Alternative 2</b>		
Highest Receptor	31	12
Assumed 24-Hour and Annual Background Levels	79	22
Project + Background Level	110	32
<b>Percentage of 24-Hour Standard</b>	<b>73%</b>	<b>64%</b>
<b>Location of Highest Receptor:</b> on southern boundary of Lower Site, adjoining I-90		
<b>Alternative 3</b>		
Highest Receptor	7	3
Assumed 24-Hour and Annual Background Levels	79	22
Project + Background Level - 24 Hour	86	24
<b>Percentage of 24-Hour Standard</b>	<b>57%</b>	<b>48%</b>
<b>Location of Highest Receptor:</b> on southern boundary of Lower Site, adjoining I-90		
<b>Alternative 4</b>		
Highest Receptor	1	>1
Assumed 24-Hour and Annual Background Levels	79	22
Project + Background Level - 24 Hour	80	22
<b>Percentage of 24-Hour and Annual Standards</b>	<b>53%</b>	<b>44%</b>
<b>Location of Highest Receptor:</b> at the Washington State Patrol Training Academy		

The project's annual concentrations were extrapolated from the 24-hour concentrations using the factors developed by PSCAA in modeling for a Notice of Construction. The assumed 24-hour and annual average background level are the average of the highest 24-hour levels and annual measurements from the Lake Forest Park monitoring site over the 1991 to 2000 period. This is a very conservative background level, one that is likely to be reached at North Bend, due to its lower density of population (resulting in fewer cars and fireplaces per acre) and a climate characterized by higher average winds (aiding in the dispersion of pollutants). The modeled 24-hour concentrations for Alternative 2 fall midway between those of two other recent analyses of sand and gravel mines (Cadman's High Rock Quarry at 11 µg/m<sup>3</sup> and Palmer Junction at 70 µg/m<sup>3</sup>).

### **3.3.3 Impacts of the Asphalt Plant**

#### **3.3.3.1 Project Description**

The proponent intends to produce 250,000 tons per year of asphalt paving material. The intended hours of operation are 5 a.m. to 10 p.m. six days a week. All the required aggregate will come from the proposed gravel mine, stored in stockpiles and loaded into the cold feed bins. The facility will be a totally enclosed batch type plant using propane/natural gas for fuel and will have a production rate of 350 tons per hour.

In a batch-mix plant system a conveyor feeds the gravel from the bins into the upper end of the revolving dryer drum. The aggregate is heated by a natural gas burner, rated at 115 million BTUs/hour. The hot gravel is then sorted by size and is stored in bins. To make a batch, hot aggregate is fed into a weigh hopper

in the correct proportions and weight and then is mixed in the pug mill. At this point liquid asphalt is injected, more mixing occurs, and then the batch is dropped into a waiting truck.

### 3.3.3.2 Operation Impacts

Emissions of various pollutants can occur at a number of places in this process as summarized in Table 5. The asphalt plant will have a natural gas burner rated at 115 million BTU's per hour. Sources of information for this plant's emissions include stack tests for PM10 for an identical plant (CSR in Everett, WA) and EPA's AP42 manual.

**TABLE 5  
SUMMARY OF EMISSION SOURCES FROM ASPHALT PLANTS**

Process	Potential Pollutant Emission
1. Loading cold feed bins	PM <sub>10</sub>
2. Conveying aggregate into drum	PM <sub>10</sub>
3. Heating & mixing aggregate in drum	PM <sub>10</sub>
4. Heating & mixing asphalt	Hydrocarbons
5. Loading truck	Hydrocarbons
6. Transporting mix	Hydrocarbons

This project will be required to meet the requirements of Best Available Control Technology (BACT). BACT is defined in the Washington Administrative Code and will be implemented for this project by the PSCAA. BACT is applied to ensure that emissions are reduced to the lowest possible levels. Table 6 summarizes typical BACT requirements for asphalt plants. BACT requirements must be met before PSCAA will approve the Notice of Construction that allows plant construction to begin.

**TABLE 6  
BACT REQUIREMENTS**

Process	BACT Requirement
1. Loading cold feed bins	Pave the truck access areas, wash down with water sprays whenever necessary to maintain wet surface
2. Conveying aggregate into drum	
3. Heating & mixing aggregate in drum	Vent mixer into baghouse-Maximum 10% allowed opacity at the baghouse exhaust stack
4. Heating & mixing asphalt	Vent hot aggregate bins & the weight Mixer/hopper into baghouse
5. Limitations on the proportion of PCS (petroleum contaminated soils) allowed into the aggregate mixture.	

Source: PSCAA

The EPA approved dispersion model (SCREEN 3 ) was used to determine the Proposal's impact upon air quality. This model uses conservative meteorological assumptions which will yield "worst case" pollutant concentrations. The results of this dispersion modeling are shown in Table 7.

**TABLE 7**  
**MODELED CONCENTRATIONS - ALTERNATIVE 2**

<b>Pollutant</b>	<b>Maximum Modeled Concentration at Lease Boundary</b>	<b>Air Quality Standard</b>
PM <sub>10</sub>	8.5 µg/m <sup>3</sup> (24 hour Average)	150 µg/m <sup>3</sup>
SO <sub>2</sub>	0.002 mg/m <sup>3</sup> (1-hour Average)	1.05 mg/m <sup>3</sup>
CO	0.17 mg/m <sup>3</sup> (1-hour Average)	40.1 mg/m <sup>3</sup>
Air Toxics		
Benzene	0.0020 µg/m <sup>3</sup> (Annual average)	0.12 µg/m <sup>3</sup> (ASIL)
Formaldehyde	0.0048 µg/m <sup>3</sup> (Annual average)	0.077 µg/m <sup>3</sup> (ASIL)

ASIL = “acceptable source impact level” and is the annual concentration that could create an additional cancer risk of one in one million.

#### **ALTERNATIVE 1 – NO ACTION**

No asphalt plant and thus no impacts.

#### **ALTERNATIVE 2 – PROPOSAL**

Asphalt plant pollutant concentrations are far below the NAAQS and represent a very low impact.

#### **Alternative 2 – Lower Site Option**

Concentrations are identical to Alternative 2 and represent a very low impact.

#### **ALTERNATIVE 3 – LOWER AND UPPER SITES (EXIT 34 AND EXIT 38)**

Concentrations are identical to Alternative 2 and represent a very low impact.

#### **Alternative 3 – Lower Site Option**

Concentrations are identical to Alternative 3 and represent a very low impact.

#### **ALTERNATIVE 4 – UPPER SITE ONLY (EXIT 34)**

No asphalt facility, thus no impacts.

### **3.3.4 Odor Impacts**

Research has been conducted to determine the minimum concentrations of chemical compounds that people can detect. Asphalt plants emit a wide variety of hydrocarbons some of which have strong and distinctive odors and have established “odor thresholds” such as toluene and xylene. Using the emission factors developed by EPA for batch asphalt facilities the maximum hourly concentrations of odoriferous compounds were determined. Table 8 compares the modeled concentrations to the odor thresholds.

**TABLE 8**  
**ODOR IMPACTS OF THE ASPHALT PLANT- ALTERNATIVES 2 AND 3**

Compound	Modeled Maximum Concentration	Odor Threshold	% of Threshold
Toluene	0.00022 PPM	0.17 PPM	0.3%
Xylene	0.00045 PPM	0.08 PPM	0.2%

Based on the data from Table 8, it is unlikely that the odors from the asphalt plant will be detectable at or beyond the boundaries of the Lower Site lease area.

### 3.3.5 Impacts of Truck Traffic at Local Intersections

The truck traffic generated by the Proposal and its alternatives is substantial. The air quality impacts of increased truck volumes at Exits 34 and 38 was analyzed using EPA's emission factor model Mobile5b and intersection dispersion model CAL3QHC. Concentrations were calculated at locations outside the lease areas and accessible to the general public as per EPA guidelines. The use of Exit 32 by project traffic was examined by the proponent's traffic consultant; but because that exit is not as likely to actually be used by project traffic, it was not modeled for air quality impacts. As shown by the results of the modeling summarized on Table 9, truck emissions do not approach the NAAQS; and, therefore, are not a significant air quality impact.

**TABLE 9**  
**PROJECT-GENERATED TRUCK EMISSION IMPACTS**

INTERSECTION	CO LEVEL	PM <sub>10</sub> LEVEL
EPA Air Quality Standards	9.0 PPM (8-hour Average)	65.0 µg/m <sup>3</sup> (24-hour Max.)
Alternative 1 (No Project in 2025)		
Exit 34	0.5 PPM	11.0 µG/M <sup>3</sup>
Exit 38	NA	NA
Alternative 2		
Exit 34- Background plus project in 2025	0.5 PPM	14.0 µG/M <sup>3</sup>
Alternative 3		
Exit 34- Background plus project in 2025	0.7 PPM	14.5 µG/M <sup>3</sup>
Exit 38- No Build in 2025	NA	NA
Exit 38- Project's effect in 2025	0.7 PPM	4.5 µG/M <sup>3</sup>
Alternative 4		
Exit 38- Project's effect in 2025	0.6 PPM	3.8 µG/M <sup>3</sup>

Note: Projections of non-project vehicles volumes for the year 2025 were not available for the Exit 38 (Fire Training Academy Road) area.

### **3.4 CUMULATIVE IMPACTS**

PM<sub>10</sub> has multiple sizable sources, and it is the pollutant for which an examination of its cumulative impacts is most warranted. Table 10 summarizes cumulative PM<sub>10</sub> concentrations and Table 11 compares PM<sub>10</sub> emissions for all the alternatives. The assumed background level is the average of the single highest 24-hour levels at PSCAA's Lake Forest Park monitoring site for the years 1991 to 1998.

**TABLE 10**  
**CUMULATIVE PM<sub>10</sub> CONCENTRATIONS - MAXIMUM 24-HOUR LEVELS**

Intersection Source	PM <sub>10</sub> Level At Lease Boundary	PM <sub>10</sub> Level At Nearest Private Property
<b>Alternative 2</b>		
Fugitive Dust (from Table 4)	30.8 µg/m <sup>3</sup>	2.9µg/m <sup>3</sup>
Asphalt Plant (from Table 7)	8.5µg/m <sup>3</sup>	8.3µg/m <sup>3</sup>
Truck Emissions (from Table 9)	8.0 µg/m <sup>3</sup> (3.0 at 468 <sup>th</sup> + 146 <sup>th</sup> )	3.0µg/m <sup>3</sup>
Project's Concentrations	47.3 ug/m <sup>3</sup>	14.2 µg/m <sup>3</sup>
Assumed Background	790ug/m <sup>3</sup>	790 µg/m <sup>3</sup>
<b>Cumulative Concentration</b>	<b>126ug/m<sup>3</sup></b>	<b>93 µg/m<sup>3</sup></b>
<b>Percentage of EPA Standards</b>	<b>84%</b>	<b>62%</b>
<b>Alternative 3</b>		
Fugitive Dust (from Table 4)	7.0µg/m <sup>3</sup>	0.7µg/m <sup>3</sup>
Asphalt Plant (from Table 7)	8.5µg/m <sup>3</sup>	8.3µg/m <sup>3</sup>
Truck Emissions (from Table 9)	9.0 µg/m <sup>3</sup>	3.4µg/m <sup>3</sup>
Project's Concentrations	24.5 ug/m <sup>3</sup>	12.4 µg/m <sup>3</sup>
Assumed Background	790 ug/m <sup>3</sup>	790 ug/m <sup>3</sup>
<b>Cumulative Concentration</b>	<b>104ug/m<sup>3</sup></b>	<b>91ug/m<sup>3</sup></b>
<b>Percentage of EPA Standards</b>	<b>69%</b>	<b>61%</b>
<b>Alternative 4</b>		
Fugitive Dust (from Table 4)	1	0
Asphalt Plant (from Table 7)	No Asphalt Plant	NA
Truck Emissions (from Table 9)	<1µg/m <sup>3</sup> (3.8 at Ollalie State Park)	2.8µg/m <sup>3</sup>
Project's Concentrations	1 ug/m <sup>3</sup>	2.8 ug/m <sup>3</sup>
Assumed Background	790ug/m <sup>3</sup>	790 ug/m <sup>3</sup>
<b>Cumulative Concentration</b>	<b>79ug/m<sup>3</sup></b>	<b>82ug/m<sup>3</sup></b>
<b>Percentage of EPA Standards</b>	<b>53%</b>	<b>55%</b>
<b>EPA Standards</b>	<b>150</b>	<b>150</b>

The cumulate impacts of the project are well under the NAAQS for PM<sub>10</sub> and thus will have a low impact upon the residential areas adjacent to the Lower or Upper Site. Sites located further from the Lower Lease area boundaries, such as the proposed school site, will have even lower concentrations.

**TABLE 11**  
**A COMPARISON OF PM<sub>10</sub> EMISSIONS FOR ALL ALTERNATIVES**

Alternative	Total Emissions in Tons Per Year
Alternative 1– No Action	No emissions
Alternative 2 – Proposal	126 tons / year
Alt. 2 Lower Site Options	126 tons/year
Alternative 3 – Lower and Upper Sites	111 tons/year
Alt. 3 Lower Site Option and Upper Site	111 tons/ year
Alternative 4 – Upper Site Only	90 tons/year

## **4.0 MITIGATION MEASURES**

### **4.1 MITIGATION OF FUGITIVE DUST IMPACTS**

The North Bend facility will initiate a dust control plan as required by PSCAA. The specific regulations pertaining to fugitive dust are contained in Sections 9.15 and 9.20 of PSCAA's Regulation I and require the use of BACT to control emissions. The application of BACT is to ensure that there will be "no visible dust" (personal conversation, F. Austin, PSCAA, 1994).

For the crushers and screens, the most commonly used dust suppression technique is a water spray system. Water spray systems have been found effective in reducing particulate matter emissions by as much as 90% (AP-42 EPA, 1995).

Frequent watering of paved of haul roads is an effective method to control dust. Dust reduction of much greater than the 50% assumed in the fugitive dust analysis of this report can be achieved by a watering program, which maintains a constantly wet road surface. Cadman has developed an effective high-pressure tire and under-carriage washing system, which is in use at their other operations. This system will be installed at the Lower Site at the entrance to the Lower Site lease area.

Reduction of particulate emissions from fugitive dust consists of many techniques. The following mitigation measures will be incorporated into the project design and/or operation:

#### **4.1.1 Alternative 2 – Proposal**

The following mitigation measures are proposed for Alternative 2 and its Lower Site Option:

- The aggregate should be maintained in a moist condition while it is being conveyed, sorted, crushed or stockpiled.
- The access roads and the processing and batch plant yards should be paved.
- The paved access roads and processing areas should be kept free of dust accumulations by frequent cleaning.
- Tracking of dust onto public roads should be minimized by washing the tires and undercarriage of all vehicles departing the processing plant area.
- There should be a low speed limit of 10 mph on the onsite paved access road to minimize the dispersion of dust lying on the roadways
- Wind erosion should be reduced by locating the processing and batch plants in a pit, at an elevation much lower than the surrounding terrain.
- The processing areas should be sheltered by earthen berms that will be planted with trees.
- Aggregate piles should be contained in 3-sided "bunkers" which will minimize the potential for wind erosion of the finer particles.

- Wide shelterbelts of evergreen conifers would assist in trapping fugitive dust and reducing the effective wind velocity within the Lower Site processing area.
- All impacts could be reduced by locating the processing plant and haul roads as far as possible from residential property.
- The aggregate from the Upper Site should be transferred to the Lower Site by covered conveyor belt rather than by trucks, thus reducing truck trips between sites.
- The conveyor belt between the Upper and Lower Sites will be covered to minimize dust emissions.

It should be noted that EPA's restrictions on the sulfur content of diesel fuels become effective in 2004 and will significantly reduce diesel particulate emissions for all diesel-powered equipment.

#### **4.1.2 Alternative 3 – Lower and Upper Sites (Exit 34 and Exit 38)**

The mitigation measures for Alternative 2 apply to Alternative 3 and its Lower Site Option except for the last item. Alternative 3 does not include the conveyor belt system down the west slope of Grouse Ridge.

#### **4.1.3 Alternative 4 – Upper Site Only (Exit 38)**

All of the above mitigation measures apply to Alternative 4.

### **4.2 MITIGATION OF ASPHALT PLANT IMPACTS**

#### **4.2.1 Alternative 2 – Proposal**

The following mitigation measure for Alternative 2 and its Lower Site Option is proposed:

- Meeting BACT requirements by venting the mixing drum and silo through the baghouse would provide mitigation of the operational impacts of the asphalt plant.

#### **4.2.2 Alternative 3 – Lower and Upper Sites (Exit 34 and Exit 38)**

The mitigation measure above is proposed for Alternative 3 and its Lower Site Option.

#### **4.2.3 Alternative 4 – Upper Site Only (Exit 38)**

Alternative 4 does not include an asphalt plant.

### **4.3 MITIGATION OF THE IMPACTS OF BURNING WOODY DEBRIS**

#### **4.3.1 Alternative 2 – Proposal**

The following mitigation measure for Alternative 2 and its Lower Site Option are proposed:

- Reduction of emissions from the burning of land clearing debris would best be achieved by chipping/grinding the debris (including tree stems, branches, roots and debris from past

logging) for use as soil conditioners or stockpiling them for later re-spreading instead of burning them. Alternatively, the woody debris could be hauled offsite for disposal by burning or chipping elsewhere.

If the proponent decides to burn the woody debris a number of regulations will apply. The proponent must obtain a Burning Permit from the Eastside Fire and Rescue Office in Issaquah. Burning Permits are limited to a single pile no more than 50' in diameter. Typical conditions placed upon Burn Permits include the meteorological conditions that must occur before burning can start and establish a "no burn" season. (personal conversation Tim Tilling).

#### **4.3.2 Alternative 3 – Lower and Upper Sites (Exit 34 and Exit 38)**

The proposed mitigation measure for Alternative 3 and its Lower Site Option is the same as that for Alternative 2.

#### **4.3.3 Alternative 4 – Upper Site Only (Exit 38)**

The proposed mitigation measure for Alternative 4 is the same as that for Alternative 2.

## **5.0 SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS**

Significant impacts are defined as levels of pollutants that are higher than federal, state or regional standards. The North Bend Gravel Operations Project is unlikely to have significant unavoidable adverse impacts to air quality when the mitigation measures described above are applied.

## 6.0 REFERENCES

- U.S. Environmental Protection Agency, 1995. *Compilation of Air Pollution Emission Factors, Volumes I & II*. EPA Document Number AP-42, Office of Air Quality Planning and Standards, Fifth Edition.
- Schwartz, Norris, Larson et al. "Episodes of high Coarse Particle Concentrations are not Associated with Increased Mortality" *Environmental Health Perspectives* Volume 107 No. 5 May 1999
- Personal conversation, Fred Austin, PSCAA, 1994.
- Personal conversation, Bill Fare, Cadman, Inc. 1999.
- Personal conversation, Eric Moldstad, local meteorologist, 1999.
- Personal conversations, Dan Moore, forester Weyerhaeuser Inc. Snoqualmie, Washington, 1999.
- Personal conversation, Gerry Pade, PSCAA, 1999.
- Personal conversations, Rod Shearer, Cadman, Inc., 1999.
- Personal conversations, Tim Tilling, Eastside Fire and Rescue, 2001
- Email from Scott McDougall, Caterpillar Inc., 1999.

## **Appendix to Technical Report**

**Model Inputs**  
**Model Outputs**

The information contained in this Appendix is on file with King County.